

WE CLAIM:

1. An apparatus comprising:

a drill string having a working end comprising at least one of drilling means for drilling a subterranean borehole and pullback means for pulling an object through a subterranean borehole;

a measurement system suitable for measuring at least one operational characteristic of at least one of said drilling means and said pullback means, said measurement system comprising a metallic section in direct contact with said drill string;

at least one toroid circumferentially disposed around a first portion of said metallic section and having toroidal electrically conductive windings; and

a non-conductive material disposed around said toroid whereby contact between said toroid and a subterranean environment during operation of said apparatus is precluded.

2. An apparatus in accordance with Claim 1, wherein a second portion of said metallic section is exposed whereby contact between said second portion and said subterranean environment during said operation of said apparatus is enabled.

3. An apparatus in accordance with Claim 1, wherein said measurement system comprises a tension measurement means connected to said working end of said drill string.

4. An apparatus in accordance with Claim 1, wherein said measurement system is disposed within a drill head connected to said working end of said drill string.

5. An apparatus in accordance with Claim 1, wherein said measurement system comprises at least one of temperature means for measuring temperature within said subterranean borehole and pressure means for measuring pressure within said subterranean borehole.

6. An apparatus in accordance with Claim 1, wherein said drill string is adapted for at least one of horizontal drilling and horizontal pullback.

7. An apparatus comprising:

at least one of a metallic pipe and a metallic rod suitable for at least one of drilling a subterranean borehole and pulling an object through a subterranean borehole; and

a transmitter in direct metallic contact with said at least one of said metallic pipe and said metallic rod, said transmitter comprising a toroid disposed circumferentially around said at least one of said metallic pipe and said metallic rod and having toroidal electrically conductive windings, and at least one non-conductive material disposed around said toroid, whereby contact between said toroid and a surrounding environment is precluded.

8. An apparatus in accordance with Claim 7 further comprising a measurement system suitable for measuring at least one operational characteristic of at least one of said drilling and said pulling operably connected to said transmitter.

9. An apparatus in accordance with Claim 7 further comprising a data receiver operably connected to one of said metallic pipe and said metallic rod, whereby said one of said metallic pipe and said metallic rod is a conduit for transmission of data between said transmitter and said data receiver.

10. An apparatus in accordance with Claim 8, wherein said measurement system comprises a tension measurement device, said tension measurement device being disposed between and connected to said at least one of said metallic pipe and said metallic rod and said object.

11. A method for retrieving operational data from a subterranean borehole comprising the steps of:

inserting a data transmitter into said subterranean borehole, said data transmitter connected to a drill string proximate a working end of said drill string;

inserting a measurement system into said subterranean borehole, said measurement system operably connected to said data transmitter;

measuring at least one operational parameter of a downhole operation in said subterranean borehole; and

transmitting data corresponding to said at least one operational parameter using said data transmitter through said drill string to a receiver without employing any intermediate relay device between said transmitter and said receiver.

12. A method in accordance with Claim 11, wherein said transmitter comprises a toroid circumferentially disposed around one of a metallic portion of said measurement system and said drill string, and a non-conductive material disposed around said toroid, whereby contact between said toroid and said subterranean borehole is precluded.

13. A method in accordance with Claim 12, wherein said data is transmitted to said receiver by magnetically inducing a signal into said drill string.

14. A downhole electrical conduit comprising:
a toroid circumferentially disposed around a mechanical metallic support, said toroid having a toroidal electrically conductive winding; and
a non-conductive material disposed around said toroid whereby contact between said toroid and a surrounding environment is precluded.

15. A downhole electrical conduit in accordance with Claim 14, wherein said mechanical support is a metallic drill string.

16. A downhole electrical conduit in accordance with Claim 15 further comprising a transmitter in direct metallic contact with said metallic drill string and in electrical communication with said toroid.

17. A downhole electrical conduit in accordance with Claim 16 further comprising a measurement system suitable for measuring at least one operational characteristic of at least one of a subterranean drilling operation and a subterranean pullback operation operably connected to said transmitter.

18. A downhole electrical conduit in accordance with Claim 17, wherein said measurement system comprises a tension measurement device, said tension measurement device being disposed between and connected to said metallic pipe and a pullback object.